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RESPONSE OF ANNUAL CHRYSANTHEMUM GENOTYPES TO DIFFERENT LEVELS OF NITROGEN

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Abstract

An experiment entitled "Response of annual chrysanthemum genotypes to different levels of nitrogen" was carried out at Satpuda Botanic Garden, College of Agriculture, Nagpur (Maharashtra), India; during winter season of the year 2011 with sixteen treatment combinations in Factorial Randomised Block Design. The treatments comprised of four different genotypes of annual chrysanthemum *viz*., NAC-04, NAC-07, NAC-10 and NAC-12 and four levels of nitrogen *viz*., 0 kg N ha^{-1} (control), 50 kg N ha^{-1}, 100 kg N ha^{-1} and 150 kg N ha^{-1}. The results revealed that significantly highest plant height and disc diameter of flower were recorded with the genotype NAC-12, whereas, significantly maximum branches and flowers $plant^{-1}$ were noted with NAC-10. However, the genotype NAC-07 flowered significantly earlier and recorded maximum flowering span, flower yield ha^{-1}, flower diameter and number of petals and whorls $flower^{-1}$. In respect of nitrogen levels, the highest dose of nitrogen (150 kg N ha^{-1}) was found significantly superior over all other levels except 100 kg N ha^{-1} in respect of plant height, branches $plant^{-1}$, flowering span, flower yield ha^{-1}, flower diameter and number of petals and whorls $flower^{-1}$. Interaction effect of genotypes of annual chrysanthemum and various nitrogen levels on all the characters under study was found non-significant except days for initiation of first flower bud.

Key words : Annual chrysanthemum, genotypes, nitrogen, flower yield, flower quality.

Introduction

Annual chrysanthemum (*Chrysanthemum coronarium*) is one of the most important flower crops grown in India, though it is originated in South Europe. It is a winter annual crop and belongs to the family *Asteraceae*. It is also known as 'Crown Daisy' or 'Garland chrysanthemum'. Because of variation in size, shape and colour of flowers, the annual chrysanthemum is popular among the people. These flowers have constant demand during the days of festivals, functions, in the place of worshiping and decoration through out the year. The climate of Maharashtra is most suitable to grow this crop with less efforts and expenditure. In Vidarbha region of Maharashtra, the local varieties of this crop are grown, which produce flowers of various sizes and hence fetch the lower market price. It is therefore felt essential to test various genotypes of annual chrysanthemum for producing flowers of better size and having other desirable qualities of market choice. It is well known fact that, an application of suitable dose of nitrogen influences vegetative growth, blooming period, flower yield and quality.

In flower industry, one of the most important aspects is maximum production of better quality flowers in order to fetch more market prices. It is likely that the local genotypes of annual chrysanthemum under the influence of varying nitrogen levels may produce flowers of desirable size and quality. Hence, present study was conducted to study the response of annual chrysanthemum genotypes to different levels of nitrogen for growth, flower yield and quality.

Materials and Methods

The present investigation was carried out at Satpuda Botanic Garden, College of Agriculture, Nagpur during winter season of the year 2011 with sixteen treatment combinations in Factorial Randomised Block Design with three replications. The treatments comprised of four genotypes of annual chrysanthemum *viz*., NAC-04, NAC-07, NAC-10 and NAC-12 and four levels of nitrogen *viz*., 0 kg N ha^{-1} (control), 50 kg N ha^{-1}, 100 kg N ha^{-1} and 150 kg N ha^{-1}.

The experimental plot was brought to fine tilth by ploughing, clod crushing and harrowing. At the time of land preparation, well rotted FYM @ 15 t ha^{-1} was mixed

uniformly in the soil before last harrowing. The field was then laid out with flat beds of the dimension 2.25 × 2.40 m. As per the treatment, uniform and healthy seedlings of four genotypes of annual chrysanthemum were transplanted in the prepared plots at the spacing of 45 × 30 cm. Treatment wise half the dose of nitrogen was applied in the form of urea before transplanting of seedlings and the remaining half dose of nitrogen was top dressed after 30 days of transplanting. However, the full dose of 50 kg phosphorus and 50 kg potassium ha^{-1} were applied in the form of single super phosphate and muriate of potash, respectively at the time of transplanting. Various observations on growth, flowering, yield and quality parameters v*iz*., plant height, branches $plant^{-1}$, days for first flower bud initiation, flowering span, flowers $plant^{-1}$ flowers yield ha^{-1}, flower diameter, disc diameter, number of petals and whorls $flower^{-1}$ of annual chrysanthemum were recorded and the data was statistically analyzed by the method suggested by Panse and Sukhatme (1967).

Results and Discussion

The data presented in tables 1 and 2 revealed that, different genotypes of annual chrysanthemum and nitrogen levels had significant effect on all growth, flowering, yield and quality parameters studied. The interaction effect of genotypes and nitrogen levels on all these parameters was found to be non-significant except days required for first flower bud initiation.

Growth

Significantly the highest plant height (107.87 cm) and maximum branches $plant^{-1}$ (42.00) in annual chrysanthemum were noted with the genotypes NAC-12 and NAC-10, respectively, whereas, the genotype NAC-07 recorded minimum plant height (84.78 cm) and branches $plant^{-1}$ (32.08). These differences in plant height and branches $plant^{-1}$ found among the genotypes of annual chrysanthemum might be due to their differential genetic make up. Jibhkate (2011) also reported maximum number of branches $plant^{-1}$ in annual chrysanthemum genotype NAC-10 under Nagpur (M.S.) conditions.

Significantly the maximum plant height (101.05 cm) and branches $plant^{-1}$ (39.82) were recorded with the highest nitrogen level *i.e.* 150 kg ha^{-1} and it was found statistically at par with 100 kg N ha^{-1} (99.91 cm and 38.86, respectively), whereas, the absolute control treatment *i.e.* 0 kg N ha^{-1} noted significantly minimum plant height (92.61 cm) and branches $plant^{-1}$ (33.38). An increase in vegetative growth was noted with increase in nitrogen level, which might be due to general improvement of growth and development of plant by nitrogenous fertilizers as nitrogen is involved in various metabolic processes of plant. Similar increase in height of plant and branches $plant^{-1}$ due to higher dose of nitrogen was recorded by Sharma *et al*. (2006) in chrysanthemum and Awchar *et al*. (2010) in gaillardia.

Flowering

Annual chrysanthemum genotype NAC-07 recorded significantly the earliest first flower bud initiation (39.90 days) and maximum flowering span (51.00 days), whereas, late flower bud initiation (44.00 days) and minimum flowering span (45.03 days) were noted with the genotype NAC-04. Earliness or lateness in flower bud initiation in annual chrysanthemum might be due to differential genetic characters of various genotypes. The results are in close conformity with the findings of Singh and Singh (2006) in marigold.

In respect of nitrogen levels, application of 0 kg N ha^{-1} took significantly minimum days (40.58 days) for initiation of first flower and recorded minimum flowering span (44.41 days), whereas, significantly late initiation of first flower bud (42.66 days) and maximum flowering span (50.34 days) were noted with the application of the highest nitrogen dose *i.e.* 150 kg ha^{-1} and it was found statistically at par with 100 kg N ha^{-1} (42.40 and 49.88 days, respectively). The maximum flowering span with late flower initiation was recorded under the treatment of the highest dose of nitrogen *i.e.* 150 kg N ha^{-1}. This might be due to increased vegetative growth of plants at higher nitrogen level that might have enhanced turgidity of flowers by increasing the rate of photosynthesis and other metabolic activities which in turn might have increased flowering span in annual chrysanthemum. These results are in line with the findings of Gaikwad *et al*. (2004) in China aster.

The interaction effect of genotypes and nitrogen levels was found to be significant (table 2). Significantly the earliest first flower bud initiation was observed with the genotype NAC-07 in combination with no application of nitrogen *i.e.* 0 kg N ha^{-1} (38.07 days), whereas, it was found significantly late with the genotype NAC-04 when applied with 150 kg N ha^{-1} (45.00 days). An early flower bud initiation might be due to the combined effect of the genotype NAC-07 with application of 0 kg nitrogen ha^{-1}.

Flower yield

The data presented in table 1 indicated that flowers $plant^{-1}$ and flower yield ha^{-1} in annual chrysanthemum was recorded significantly higher in the genotypes NAC-10 (127.97) and NAC-07 (16.09 t), respectively. However, minimum flowers $plant^{-1}$ and flower yield ha^{-1} were noted with the genotype NAC-04 (88.99 and 12.06

Table 1: Effect of genotypes and nitrogen levels on growth, flower yield and quality of annual chrysanthemum

Treatments	Plant height (cm)	Branches plant^{-1}	Flowering span (days)	Flowers plant^{-1}	Flower yield ha^{-1} (t)	Flower diameter (cm)	Disc diameter (cm)	No. of petals flower^{-1}	No. of whorls flower^{-1}
Genotypes (V)									
V_1- NAC-04	93.89	34.33	45.03	88.99	12.06	5.13	1.13	90.58	4.07
V_2- NAC-07	84.78	32.08	51.00	106.84	16.09	5.89	1.39	148.83	4.47
V_3- NAC-10	103.81	42.00	48.92	127.97	14.50	4.81	1.48	72.17	3.87
V_4- NAC-12	107.87	40.04	47.15	118.66	14.06	5.42	1.54	93.50	4.07
'F' test	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig**	**Sig.**	**Sig.**
SE (m) ±	0.68	0.45	0.24	1.94	0.30	0.05	0.02	2.00	0.06
CD at 5%	1.98	1.30	0.69	5.61	0.87	0.16	0.06	5.77	0.18
Nitrogen levels (N)									
N_1-0 kg N ha^{-1} (control)	92.61	33.38	44.41	97.39	11.80	4.84	1.27	83.61	4.11
N_2-50 kg N ha^{-1}	96.76	36.37	47.46	107.87	13.93	5.26	1.35	98.79	4.52
N_3-100 kg N ha^{-1}	99.91	38.86	49.88	118.50	15.41	5.52	1.43	109.66	4.81
N_4-150 kg N ha^{-1}	101.05	39.82	50.34	118.68	15.55	5.61	1.47	113.00	4.93
"F" test	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**
SE (m) ±	0.68	0.45	0.24	1.94	0.30	0.05	0.02	2.00	0.06
CD at 5%	1.98	1.30	0.69	5.61	0.87	0.16	0.06	5.77	0.18
Interaction effect (V x N)									
'F' test	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**	**N.S.**
SE (m) ±	1.37	0.90	0.48	3.8	0.61	0.11	0.04	4.00	0.12
CD at 5%	-	-	-	-	-	-	-	-	

t, respectively). Variation in the production of flowers plant^{-1} and flower yield ha^{-1} might be due to variation in vegetative growth and flower quality parameters in different genotypes and also due to their differential genetic make up. Similar variation in the production of annual chrysanthemum flowers due to genotypes was also reported by Jibhkate (2011).

An application of 150 kg N ha^{-1} noted significantly maximum flowers plant^{-1} (118.68) and flower yield ha^{-1} (15.55 t), which was found to be statistically at par with 100 kg N ha^{-1} (118.50 and 15.41 t, respectively), whereas, significantly minimum number of flowers plant^{-1} (97.39) and flower yield ha^{-1} (11.80 t) were noted with no application of nitrogen (absolute control treatment). An increase in flower yield due to application of the higher nitrogen dose (150 and 100 kg ha^{-1}) might be due to active role of suitable dose of nitrogen in producing more vigorous growth of plant due to the production and accumulation of more photosynthates, which would have diverted to the sink resulting into more flower yield ha^{-1} in annual chrysanthemum. Similar results are reported by Dorajeerao and Mokashi (2011) and Chopde *et al*. (2011) in chrysanthemum and golden rod, respectively.

Flower quality

The quality parameters *viz*., flower diameter (5.89 cm), number of petals flower^{-1} (148.83) and number of whorls flower^{-1} (4.47) were found significantly highest with the genotype NAC-07, whereas, significantly maximum disc diameter was noted with the genotype NAC-12 (1.54 cm), which was statistically at par with the genotype NAC-10 (1.48 cm). However, flower diameter, number of petals flower^{-1} and number of whorls flower^{-1} were found significantly lowest with the genotype NAC-10 (4.81 cm, 72.17 and 3.87, respectively), whereas, the lowest disc diameter was recorded with the genotype NAC-04 (1.13 cm). The variation in quality parameters of the flowers of annual chrysanthemum might have been due to differential genetic make up of the genotypes. Similar variation in the quality parameters of the marigold hybrids was noticed by Singh and Singh (2006).

Significantly the maximum flower diameter (5.61 cm), disc diameter (1.47 cm), petals flower^{-1} (113.00)

Table 2 : Effect of genotypes and nitrogen levels on days for first flower bud initiation in annual chrysanthemum.

Genotypes	Days for first flower bud initiation (days)				
	Nitrogen levels				
	N_1-0 kg N ha^{-1}	N_2-50 kg N ha^{-1}	N_3-100 kg N ha^{-1}	N_4-150 kg N ha^{-1}	Mean
V_1- NAC-04	42.47	43.67	44.87	45.00	44.00
V_2- NAC-07	38.07	39.87	40.80	40.87	39.90
V_3- NAC-10	41.27	42.20	41.27	41.80	41.63
V_4- NAC-12	40.53	41.40	42.70	43.00	41.91
Mean	40.58	41.78	42.40	42.66	
	F-test	SE (m) ±	CD at 5%		
Genotypes (V)	Sig.	0.20	0.60		
Nitrogen levels (N)	Sig.	0.20	0.60		
Interaction (V × N)	Sig.	0.41	1.20		

and whorls $flower^{-1}$ (4.93) were recorded with the highest nitrogen level *i.e.* 150 kg ha^{-1} and it was found statistically at par with 100 kg N ha^{-1} (5.52 cm, 1.43 cm, 109.66 and 4.81, respectively), whereas, the absolute control treatment *i.e.* 0 kg N ha^{-1} noted significantly minimum values (4.84 cm, 1.27 cm, 83.61 and 4.11, respectively). This might be due to increased photosynthetic activity and better vegetative growth obtained under higher dose of nitrogen, which leads to production of better size and quality of annual chrysanthemum flower. The results could paint in the same direction of Sonwane *et al*. (2008) in China aster and Patel and Chaudhari (2011) in chrysanthemum.

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